

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P83031PC00/JRC		FOR FURTHER ACTION		See Form PCT/IPEA/416
International application No. PCT/GB2004/002773		International filing date (day/month/year) 28.06.2004		Priority date (day/month/year) 27.06.2003
International Patent Classification (IPC) or national classification and IPC B01D21/26, B01D17/02				
Applicant HYDRO INTERNATIONAL PLC et al.				
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau) a total of 7 sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>				
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input checked="" type="checkbox"/> Box No. VIII Certain observations on the international application</p>				
Date of submission of the demand 12.04.2005		Date of completion of this report 08.06.2005		
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized Officer Fourgeaud, D Telephone No. +49 89 2399-7047		



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**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/GB2004/002773

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-3, 6-11	as originally filed
4, 5	received on 12.04.2005 with letter of 08.04.2005

Claims, Numbers

1-23	received on 12.04.2005 with letter of 08.04.2005
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Drawings, Sheets

1/3-3/3	as originally filed
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- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
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International application No.
PCT/GB2004/002773

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-23
	No: Claims	
Inventive step (IS)	Yes: Claims	1-23
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-23
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

The following documents (D) are mentioned in the International Search Report;

- D1: WO 00/62888 A (ANDOH ROBERT YAW GYAMFI ; LE CORNU PAUL (GB);
FARAM MIKE (GB); HYDRO I) 26 October 2000 (2000-10-26)
- D2: EP-A-0 637 653 (VSB VOGELSBERGER UMWELTECHNIS) 8 February 1995
(1995-02-08)
- D3: EP-A-0 038 752 (BARDET ANDRE SA) 28 October 1981 (1981-10-28)
- D4: GB-A-2 189 413 (HYDRO INT LTD) 28 October 1987 (1987-10-28)

1. The document D1 is regarded as being the closest prior art to the subject-matter of claim 1 (sole independent claim), and shows (the references in parentheses applying to this document) a hydrodynamic treatment device (see figure 1) providing an inner region and an outer region in a cylindrical vertical vessel, both regions being separated and delimited by a partition (30). Said vessel further provides a frustoconical base (4) where the solid matters settle. The inner region is annular (see figures) and is limited in its upper part by the partitions (30) and (31), and in its lower part by the tubular member (10) and the dip plate (12).

The subject-matter of claim 1 differs from this known separator in that the inner region is closed at its lower end. As a matter of fact, in D1, said inner region is opened since the dip plate (12) is held by rods either to the base (4) or to the lid (5) (see page 12, lines 26-30) and is not in direct contact with the conical member (9).

The subject-matter of claim 1 is therefore new (Article 33(2) PCT).

2.1. The problem to be solved by the present invention may be regarded as to provide a new device with improved performances compared to the devices known from the prior art.

2.2. The solution to this problem proposed in claim 1 of the present application is

considered as involving an inventive step (Article 33(3) PCT) for the following reasons: the fact that the inner region is closed at its lower end allows eventual solid matters to settle on the wall closing said inner region (figure 2 on the present application, wall 30 in inner region 28). Then, removal of solids is provided in the outer region, but an additional removal of solids is also provided in the inner region with this construction. None of the documents of the prior art suggests such a modification for improving the performance of the device; D2-D4 do not give any hint about closing an inner region formed by partitions. Accordingly, an inventive step is recognized.

3. Claims 2-23 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

Re Item VIII

Certain observations on the international application

Article 6 PCT:

4.1. Present claim 1 actually covers the embodiment that the inner region is closed at its lower end by the frustoconical base itself, the partition 24 thereby being directly supported onto said frustoconical base 16. This renders the scope of said claim 1 broader than supported by the description since according to the drawings, a gap 32 is present between the partition 24 and the base 16.

Since present claim 1 does not mention the apertures 34 on the central partition 28, such an embodiment seems not to achieve properly the separation of the solid matter from the liquid, since it could not be evacuated by the outlet 18 whose access would be closed by the inner partition 24. A clarification is then necessary.

A similar remark applies for the central partition 26 whose lower end is also not delimited i.e. the reader does not know if said partition is longer or of the same length as the partition 24. Then, claim 1 does not contain all the essential features necessary to the definition of the invention (article 6 PCT).

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(SEPARATE SHEET)**

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4.2. Present claim 22 seems to be obsolete since present claim 1 already mentions that the inner region, which is formed between the inner partition 24 and the central partition 28, is annular. The inner partition is consequently and necessarily cylindrical too. This feature should also appear in claim 1 (article 6 PCT).

5.1. Independent claim 1 is not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art (document D1) being placed in the preamble (Rule 6.3(b)(I) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).

5.2. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

cylindrical vessel containing a hollow column which terminates at its lower end at a downwardly diverging conical member. Shortly above the conical member, the hollow column has openings which permit flow from the main body of the vessel into the column. There is an outlet for such flow at the top of the column.

A dip plate surrounds the column, and acts to stabilise flow patterns within the vessel. In operation, flow can take place around the dip plate to the openings in the column, and thence up the column to the outlet.

The present invention arises from a desire to increase the removal and retention efficiencies of separators of the type disclosed in GB 2082941, GB 2158741 and WO00/62888.

According to the present invention there is provided a hydrodynamic treatment device for separating material from a liquid flow, the device comprising a vessel having a cylindrical outer wall and an inner partition which divides the interior of the vessel into outer and inner separation regions which communicate with each other across the inner partition, the vessel having an inlet which is directed into one of the inner and outer regions to promote a rotating flow in the vessel, a liquid outlet which extends from the other of the inner and outer regions, and a frustoconical base which converges downwardly to an outlet opening for separated material, the inner separation region being annular, and defined at its inner periphery by a central cylindrical partition, the interior of which is open at its lower end to provide access to the outlet opening, the inner separation region being closed at

its lower end.

One result of adopting the features of the present invention is that flow patterns established in the inner separation region are not propagated through the outlet opening to a separated material collection region. In known devices, such flow patterns can stir up collected material, and cause it to migrate back through the outlet opening to rejoin the main flow.

Preferred embodiments constructed in accordance with the present invention demonstrate excellent removal and retention efficiencies.

In a preferred embodiment, the inlet opens into the outer separation region and the outlet opens into the inner separation region, although the reverse arrangement is possible.

Communication between the outer and inner separation regions may be provided by means of at least one aperture in the inner partition. The or each aperture may be disposed adjacent the lower end of the inner partition.

A screen may be provided over the or each aperture. In one embodiment, the aperture may comprise a circumferential slot extending entirely around the inner partition.

A frusto-conical downwardly extending wall may be provided at the lower end of the inner separation region. The inner partition may abut the frusto-conical wall, so that the frusto-conical wall serves to close the lower end of the inner separation region. The frusto-conical wall preferably projects beyond the inner partition, the outer edge of the frusto-conical wall being spaced from the frusto-conical base of the

CLAIMS

1. A hydrodynamic treatment device for separating material from a liquid flow, the device comprising
5 a vessel having a cylindrical outer wall and an inner partition which divides the interior of the vessel into outer and inner separation regions which communicate with each other across the inner partition, the vessel having an inlet which is
10 directed into one of the inner and outer regions to promote a rotating flow in the vessel, a liquid outlet which extends from the other of the inner and outer regions, and a frustoconical base which converges downwardly to an outlet opening for
15 separated material, the inner separation region being annular, and defined at its inner periphery by a central cylindrical partition, the interior of which is open at its lower end to provide access to the outlet opening, the inner separation
20 region being closed at its lower end.
2. A hydrodynamic treatment device as claimed in claim 1, in which the inlet opens into the outer separation region and the outlet opens into the
25 inner separation region.
3. A hydrodynamic treatment device as claimed in any claim 1 or 2, in which the inner separation region communicates with the outer separation region
30 through at least one aperture formed in the inner partition.

4. A hydrodynamic treatment device as claimed in claim 3, in which the or each aperture is disposed adjacent the lower end of the inner partition.
- 5 5. A hydrodynamic treatment device as claimed in claim 3 or 4, in which the aperture comprises a circumferentially extending slot in the inner partition.
- 10 6. A hydrodynamic treatment device as claimed in claim 3 or 4, in which the aperture comprises a circumferential gap between the inner partition and a wall closing the lower end of the inner separation region.
- 15 7. A hydrodynamic treatment device as claimed in any one of claims 3 to 6, in which the or each aperture is provided with a screen.
- 20 8. A hydrodynamic treatment device as claimed in any one of the preceding claims, in which the inner separation region is closed at its lower end by a wall.
- 25 9. A hydrodynamic treatment device as claimed in claim 8, in which the wall is frusto-conical and diverges in the downwards direction.
- 30 10. A hydrodynamic treatment device as claimed in claim 11, in which the frusto-conical wall projects beyond the inner partition.

11. A hydrodynamic treatment device as claimed in any one of claims 8 to 10, in which the wall terminates short of the frusto-conical base of the vessel, thereby defining an annular gap between the frusto-conical base and the wall.
12. A hydrodynamic treatment device as claimed in any one of the preceding claims, in which a filter media is provided in the inner separation region.
13. A hydrodynamic treatment device as claimed in claim 12, in which the filter media substantially fills the inner separation region.
14. A hydrodynamic treatment device as claimed in claim 12 or 13, in which the filter media comprises a replaceable cartridge.
15. A hydrodynamic treatment device as claimed in any one of the preceding claims, in which an outlet duct extends from the liquid outlet through the cylindrical outer wall of the vessel.
16. A hydrodynamic treatment device as claimed in claim 15, in which an inlet duct extends to the inlet of the vessel through the cylindrical outer wall of the vessel, the inlet duct being aligned with the outlet duct.
17. A hydrodynamic treatment device as claimed in claim 16, in which the inlet is disposed below the inlet duct and comprises an inlet port oriented to discharge inlet flow into the vessel in a

tangential direction with respect to the axis of the cylindrical outer wall.

18. A hydrodynamic treatment device as claimed in
5 claim 16 or 17, in which the inlet and outlet ducts are disposed at an upper region of the vessel.
19. A hydrodynamic treatment device as claimed any one
10 of claims 16 to 18, in which the inlet duct communicates with the inlet through a chamber, the chamber being provided with bypass means for allowing flow from the chamber to the inner separation region, by passing the outer separation
15 region.
20. A hydrodynamic treatment device as claimed in
claim 19, when appendant to claim 18, in which the inlet port is provided in the wall of an inlet
20 shute which extends downwardly from the chamber.
21. A hydrodynamic treatment device as claimed in
claim 20, in which the bypass means comprises a weir disposed between the chamber and the inner
25 separation region, the overflow edge of the weir being at a level higher than the inlet port.
22. A hydrodynamic separator as claimed in any one of
the preceding claims, in which the inner partition
30 is cylindrical.

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23. A hydrodynamic separator as claimed in any one of the preceding claims, in which the inner partition is coaxial with the outer wall.